UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/076,915	02/14/2002	Anna Lee Tonkovich	13007B	1868

7590 07/24/2007

Frank S. Rosenberg
18 Echo Hill Lane
Moraga, CA 94556

EXAMINER	
LEUNG, JENNIFER A	

ART UNIT	PAPER NUMBER
1764	

MAIL DATE	DELIVERY MODE
07/24/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/076,915	TONKOVICH ET AL.	
	Examiner	Art Unit	
	Jennifer A. Leung	1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 April 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31 and 75-100* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *5 and 98* is/are allowed.

6)☒ Claim(s) *1-4,6-29,75-79,82-97,99 and 100* is/are rejected.

7)☒ Claim(s) *30,31,80 and 81* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 5/29/07
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment submitted on April 17, 2007 has been received and carefully considered. Claims 32-74 are cancelled. Claims 86-100 are newly added. Claims 1-31 and 75-100 are currently under consideration.

Claim Objections

2. Claims 10, 24 and 26 are objected to because of the following informalities:

In claim 10, lines 23-24: the limitation is a duplicate of the limitation already presented in lines 21-22.

In claim 24, line 17: "•m" should be changed to --μm--.

In claim 26, line 3: "•m" should be changed to --μm--.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 13-17, 21, 76, 85, 87-90, 92, 93, 96, 99 and 100 are rejected under 35 U.S.C. 102(b) as being anticipated by Bottcher et al. (US 5,657,818).

Regarding claims 13, 14, 76, 85 and 100, Bottcher et al. (see FIGs. 1-5; column 1, line 50 to column 2, line 49) discloses a process comprising:

stacking a plurality of shims (i.e., sheets **2**) such that a continuous flow path is formed through the shims (e.g., continuous channels **1**, formed by aligned openings **7**);

wherein the flow path **1** extends in a direction substantially parallel to shim **2** thickness (see FIGs. 1, 2);

wherein the plurality of shims comprises at least three, or at least five, adjacent shims **2** (see column 1, lines 31-35) through which the flow path **1** is formed and wherein a straight, unobstructed line is present through the flow path **1** in said at least three shims **2** (see, e.g., FIGs. 1, 2);

bonding the shims (see column 2, lines 32-36) to form the device capable of performing the unit operation (see column 2, lines 49-55) on a fluid;

passing the fluid into the device (i.e., via openings **9** in the cover plate 5) such that the fluid passes through the flow path **1** in said shims; and

performing the unit operation on the fluid as it passes through the flow path **1**;

wherein the unit operation is selected from the group consisting of distilling, adsorbing, compressing, expanding, absorbing, vaporizing, condensing and combinations thereof (see column 2, lines 49-55).

Regarding claim 15, Bottcher et al. discloses that the flow path may be configured such that it does not connect with any other flow paths (see, e.g., FIGs. 1, 2, wherein the flow paths **1** are separate from one another, and pass from a corresponding opening **9** in the top cover plate **5** to a corresponding opening **9** in the bottom cover plate **5**).

Regarding claims 16 and 17, Botcher et al. discloses that a second fluid may pass through a second flow path (e.g., defined by flow spaces **4**) in said at least three shims, wherein the fluid in the flow path **1** and the fluid in the second flow path **4** do not mix.

Regarding claim 21, the fluid in the second flow path **4** may comprise a heat exchange fluid (see column 2, lines 49-55; column 1, lines 56-60).

Regarding claims 87 and 93, Bottcher et al. (see FIGs. 1-5; column 1, line 50 to column 2, line 49) discloses a process of making a device (i.e., a permeable structure) for conducting a unit operation comprising:

stacking a plurality of shims (i.e., sheets **2**) such that a continuous flow path is formed through the shims (e.g., continuous channels **1**, formed by aligned openings **7**);

wherein the flow path **1** extends in a direction substantially parallel to shim **2** thickness (see FIGs. 1, 2);

wherein, as best understood, the flow path **1** in at least one of the shims **2** further comprises a section in which the flow path extends in a direction substantially perpendicular to shim thickness (e.g., the openings **7** that define the flow paths **1** are shaped in a linear or oblong fashion, and therefore, the openings define a flow path that extends in a direction substantially perpendicular to the shim thickness; see, e.g., FIGs. 1, 2, 5; also, see, e.g., column 2, lines 9-16);

wherein the plurality of shims comprises at least three, or at least five, adjacent shims **2** (see column 1, lines 31-35) through which the flow path **1** is formed and wherein a straight, unobstructed line is present through the flow path **1** in said at least three shims **2** (see, e.g., FIGs. 1, 2);

wherein the flow path **1** in said at least three shims does not mix with any other flow paths (see, e.g., FIGs. 1, 2, wherein the flow paths **1** run linear and parallel to one another);

wherein the three shims are configured such that a unit operation can be performed on a fluid in the flow path in which the straight, unobstructed line is present in said at least three adjacent shims (e.g., heat exchanging, condensing, reacting, etc.; see column 2, lines 49-55); and

bonding the shims to form the device capable of performing the unit operation on a fluid (see column 2, lines 32-36).

Regarding claim 88, Bottcher et al. further discloses that the flow path **1** may be configured such that it does not connect with any other flow paths (see, e.g., FIGs. 1, 2, wherein the flow paths **1** are separate from one another, and pass from a corresponding opening **9** in the top cover plate **5** to a corresponding opening **9** in the bottom cover plate **5**).

Regarding claim 89, Bottcher et al. further discloses that the section in which the flow path extends in a direction substantially perpendicular to the shim **2** thickness may comprise a header, wherein the header connects to plural flow paths **1** that extend in a direction substantially parallel to the shim thickness (see, e.g., column 2, lines 9-16).

Regarding claim 90, Bottcher et al. further discloses that the section in which the flow path **1** extends in a direction substantially perpendicular to the shim **2** thickness comprises a connection to an inlet or outlet (i.e., a connection to inlet or outlet openings **9** in the cover plates 5; see FIGs. 1, 2).

Regarding claim 92, Bottcher et al., as best understood, further discloses that the flow path 1 that is in the section in which the flow path extends in a direction substantially

perpendicular to the shim thickness also connects to a second section comprising at least three adjacent shims through which the flow path is formed and wherein a straight, unobstructed line is present through the flow path in said at least three shims (see, e.g., column 2, lines 9-16).

Regarding claim 96, Bottcher et al. further discloses that the flow path **1** may be configured such that it does not connect with any other flow paths (see, e.g., FIGs. 1, 2, wherein the flow paths **1** are separate from one another, and pass from a corresponding opening **9** in the top cover plate **5** to a corresponding opening **9** in the bottom cover plate **5**).

Regarding claim 99, Bottcher et al. further discloses at least five adjacent shims (see column 1, lines 31-35).

Instant claims 13-17, 21, 76, 85, 87-90, 92, 93, 96, 99 and 100 read on the process of Bottcher et al.

4. Claim 10 is rejected under 35 U.S.C. 102(b) as being anticipated by Symonds (WO 01/35043).

Symonds discloses a process comprising:

stacking a plurality of shims (i.e., discs **22** within portion **11** of assembly **10**; FIGs. 1 and 2) such that a continuous first flow path is formed through the shims (i.e., as defined by aligned openings **29**, between inlet **12** and outlet **13**), and a continuous second flow path is formed through the shims (i.e., as defined by aligned openings **26**, between inlet **21** and outlet **19**);

wherein the first and second flow paths are substantially parallel to the shim thickness (see, e.g., FIG. 1);

wherein the plurality of shims **22** comprise at least three shims through which the first and second flow paths are formed, and wherein a straight, unobstructed line is present through

the first flow path **12/29/13** in said at least three shims; and a straight, unobstructed line is present through the second flow path **21/26/19** in said at least three shims (see FIGs. 1, 2);

wherein the first flow path **12/29/13** in said at least three shims does not mix with any other flow paths (see FIGs. 1, 2);

bonding the shims (see page 6, second paragraph) to form a device capable of performing a unit operation on a fluid;

passing a first fluid into the device (i.e., via inlet **12**) such that the fluid passes through the first flow path in said plurality of shims; and performing at least one first unit operation on the first fluid as it passes through the first flow path (e.g.,, reacting, in the case of the device being configured as a packed bed catalytic reactor; page 1, second paragraph; page 4, second to last paragraph; claim 26); and

passing a second fluid into the device (i.e., via inlet **21**) such that the fluid passes through the second flow path in said plurality of shims; and performing at least one second unit operation on the second fluid as it passes through the second flow path (e.g., heating or cooling, for controlling the temperature of the catalytic reaction occurring within the first flow path).

Instant claim 10 reads on the process of Symonds.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-3, 6-9, 75, 78, 79, 86 and 95 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818) in view of Yamashita (JP 2000-329490).

Regarding claims 1, 8 and 9, Bottcher et al. (see FIGs. 1-5; column 1, line 50 to column 2, line 49) discloses process of making a device (i.e., a permeable structure) for conducting a unit operation comprising:

stacking a plurality of shims (i.e., sheets **2**) such that a plurality of continuous flow paths are formed through the shims (e.g., continuous channels **1**, formed by aligned openings **7**);

wherein the plurality of continuous flow paths **1** extend in a direction substantially parallel to shim **2** thickness (see FIGs. 1, 2);

wherein the plurality of continuous flow paths **1** are connected to a common header (see, e.g., column 2, lines 9-16);

wherein the plurality of shims comprises at least three adjacent shims **2** (see column 1, lines 31-35) through which the flow path **1** is formed and wherein a straight, unobstructed line is present through the flow path **1** in said at least three shims **2** (see, e.g., FIGs. 1, 2);

wherein the flow paths **1** are defined by the borders of the aligned apertures **7** in said at least three shims **2**;

wherein the three shims are configured such that a unit operation can be performed on a fluid in the flow path in which the straight, unobstructed line is present in said at least three adjacent shims (e.g., heat exchanging, condensing, reacting, etc. with fluids; see column 2, lines 49-55); and

bonding the shims to form the device capable of performing the unit operation on a fluid (see column 2, lines 32-36).

The process of making as disclosed by Bottcher et al. is the same as the instantly claimed process, but Bottcher et al. is silent as to the borders of apertures 7 having a circumference at least 20% populated by edge features.

Yamashita et al. (see FIGs. 2, 3) teaches a process of making a device by stacking a plurality of shims (i.e., plates **11(1)**, **11(2)**... **11(n)**; or plates **21(1)**, **21(2)**... **21(n)**), wherein a continuous flow path extends in a direction substantially parallel to the shim thickness, and, in particular, the continuous flow path is defined by the borders of apertures **12b**, **22b**, said borders having a circumference at least 20% populated by edge features (i.e., a saw tooth configuration or a wave configuration toothing). (see also sections [0012]-[0013]) and claim 7).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apertures in the process of Bottcher et al. with a circumference at least 20% populated by edge features, because the edge features increase the surface area of the continuous pathway, and thereby increases heat transfer within the device, as taught by Yamashita et al. (see, e.g., section [0012]).

Regarding claims 2 and 78, Bottcher et al. discloses that the aperture 7 comprises a shape selected from the group consisting of circles, ovals, irregular shapes, and rectangles with rounded

corners (see FIGs. 1-5). In any event, the recitation of a specific shape for the apertures does not confer patentability to the claim, since it has been held that changes in shape involves only ordinary skill in the art. *In re Dailey* 149 USPQ 47, 50 (CCPA 1966); *Glue Co. v Upton* 97 US 3, 24 (USSC 1878).

Regarding claim 3, Bottcher et al. discloses that the aperture **7** in each of the at least three adjacent shims **2** may comprise a circle (see, e.g., FIGs. 3, 5), wherein the shims **2** are bonded to form the device (see column 2, lines 33-37), wherein the device comprises a flow path having a cylindrical shape.

Regarding claims 6 and 94, Bottcher et al. further discloses that the at least one flow path 1 in said at least three shims may be configured such that it does not connect with any other flow paths (see, e.g., FIGs. 1, 2, wherein the flow paths **1** are separate from one another, and pass from a corresponding opening **9** in the top cover plate **5** to a corresponding opening **9** in the bottom cover plate **5**).

Regarding claims 7 and 79, Bottcher et al. further discloses that the centers of the apertures **7** may be offset from the common axis of the row of holes, such that structures can be built up in which the channels formed by the holes obtain a stepped or helical surface, thereby, inherently, defining a static mixer within the flow path (see column 1, lines 36-41 and 63-64).

Regarding claim 75, Bottcher et al. discloses that the flow path **1** is formed by an aperture **7** in each of the at least three adjacent shims **2**, wherein the shape may comprise an irregular shape (see, e.g., holes **7a** in FIG. 3). In any event, the recitation of a specific shape for the apertures does not confer patentability to the claim, since it has been held that changes in shape

involves only ordinary skill in the art. *In re Dailey* 149 USPQ 47, 50 (CCPA 1966); *Glue Co. v Upton* 97 US 3, 24 (USSC 1878).

Regarding claim 86, Bottcher et al. further discloses that the at least one flow path **1** in said at least three shims may be configured such that it does not connect with any other flow paths (see, e.g., FIGs. 1, 2, wherein the flow paths **1** are separate from one another, and pass from a corresponding opening **9** in the top cover plate **5** to a corresponding opening **9** in the bottom cover plate **5**).

Regarding claim 95, Yamashita et al. (FIGs. 2, 3; sections [0012]-[0013]) and claim 7) further teaches that the borders of the apertures **12b**, **22b** is at least 50% populated by edge features (i.e., a saw tooth configuration or a wave configuration toothing). Although Yamashita et al. is silent as to whether the edge features cause at least a 1% variation in the diameter of the aperture, the specific percentage of diameter variation is not considered to confer patentability to the claim since the precise percentage would have been considered a result effective variable by one having ordinary skill in the art. Accordingly, one having ordinary skill in the art would have routinely optimized the amount of diameter variation caused by the edge features in the modified process of Bottcher et al. to obtain the desired level of heat transfer efficiency within the device. *In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980), and since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818) in view of Yamashita (JP 2000-329490), as applied to claim 1 above, and further in view of Bottcher et al. (US 5,212,004).

Bottcher et al. '818 discloses that the at least 3 adjacent shims may comprise "different sheet patterns." (see column 1, lines 31-35). Bottcher et al. '818, however, is silent as to whether the at least 3 adjacent shims may be identical. Bottcher et al. '004, however, teaches that a continuous flow path may be formed by stacking 3 adjacent shims that are identical (see column 2, lines 56-62). It would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to configure the at least 3 adjacent shims to be identical in the process of Bottcher et al. '818, in order to allow for the surface ratio of the various flow paths to be varied and thus adapted to meet a particular heat transfer requirement, as taught by Bottcher et al. '004.

7. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Symonds (WO 01/35043) in view of Yamashita et al. (JP 2000-329490).

Regarding claim 11, Symonds is silent as to the borders of the apertures **29** which define the first flow path **12/29/13** having a circumference at least 20% populated by edge features.

Yamashita et al. (see FIGs. 2, 3) teaches a process of making a device by stacking a plurality of shims (i.e., plates **11(1)**, **11(2)**... **11(n)**; or plates **21(1)**, **21(2)**... **21(n)**), wherein a continuous flow path extends in a direction substantially parallel to the shim thickness, and, in particular, the continuous flow path is defined by the borders of apertures **12b**, **22b**, said borders having a circumference at least 20% populated by edge features (i.e., a saw tooth configuration or a wave configuration toothing). (see also sections [0012]-[0013]) and claim 7).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apertures in the process of Symonds with a circumference at least 20% populated by edge features, because the edge features increase the surface area of the

continuous pathway, and thereby increases heat transfer within the device, as taught by Yamashita et al. (see, e.g., section [0012]).

Regarding claim 12, Yamashita et al. further teaches that borders of the apertures in at least one of said shims comprises a circumference that is at least 20% populated by edge features (i.e., inner circumference of an opening **12b** comprising a saw tooth, FIG. 2; inner circumference of an opening **22b** comprising a wave configuration toothing, FIG. 3; see also sections [0012]-[0013]) and claim 7), and a smooth border in another of said shims (i.e., inner circumference of an opening **12a**, FIG. 2; inner circumference of an opening **22a**, FIG. 3). It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apertures in the process of Symonds to comprise at least 20% edge features, or a smooth border, on the basis of suitability for the intended use, in order to the desired amount of surface area within the continuous pathway to vary the heat transfer efficiency of the device, as taught by Yamashita et al. (see, e.g., section [0012]).

8. Claims 18-20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818) in view of Bottcher et al. (US 5,212,004).

Regarding claims 18-20, Bottcher et al. '818 disclose that the fluid the flow path **1** and the fluid in the second flow path **4** are separated, and the flow path **1** has rounded edges (see, e.g., FIGs. 1, 2). Bottcher et al. '818, however, is silent as to the flow paths **1** and **4** being separated by a distance of 5 mm or less, or 1 mm or less. In any event, it would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the distance according to the claimed range in the process of Bottcher et al. '818, on the basis of suitability for the intended use and absent a showing of unexpected results thereof, because the

claimed distances would have been considered conventional for providing a suitable heat transfer distance, as suggested by Bottcher et al. '004 (see, e.g., column 2, lines 5-37). In addition, it would have been obvious for one of ordinary skill in the art at the time the invention to select an appropriate pressure difference of the fluids in the first flow and the second flow path in the process of Bottcher et al. '818, on the basis of suitability for the intended use and absent showing any unexpected results thereof, because it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art, *In re Aller, 105 USPQ 233*.

Regarding claim 22, Bottcher '818 further discloses that the first flow path may comprise first supports that extend across the flow path, and the second flow path may comprise second supports that extend across the second flow path, wherein the first and second supports are staggered (see column 1, lines 38-41 and 63-64; also, column 2, lines 5-8).

9. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818).

Bottcher et al. further discloses that the device may be used for performing the unit operations of reacting, or for burning gaseous or liquid fuels (see column 2, lines 49-55). Burning comprises an exothermic reaction. Thus, it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to configure the second composition to comprise a reaction composition (e.g., a gaseous or liquid fuel) such that the reaction composition reacts exothermically (e.g., by burning), as specifically suggested by Bottcher et al.

10. Claims 24-26, 77 and 97 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818) in view of Haswell et al. (Article: *Chemical and biochemical microreactors*).

Regarding claims 24 and 26, Bottcher et al. (see FIGs. 1-5; column 1, line 50 to column 2, line 49) discloses a process comprising:

stacking a plurality of shims (i.e., sheets **2**) such that a continuous flow path is formed through the shims (e.g., continuous channels **1**, formed by aligned openings **7**);

wherein the flow path **1** extends in a direction substantially parallel to shim **2** thickness (see FIGs. 1, 2);

wherein the plurality of shims comprises at least three shims **2** (see column 1, lines 31-35) through which the flow path **1** is formed;

bonding the shims (see column 2, lines 32-36) to form the device capable of performing a unit operation (see column 2, lines 49-55) on a fluid;

passing the fluid into the device (i.e., via openings **9** in the cover plate 5) such that the fluid passes through the flow path **1** in said shims; and

performing the unit operation on the fluid as it passes through the flow path **1** in which a straight, unobstructed line is present through the flow path **1** in said at least three shims **2** (see, e.g., FIGs. 1, 2).

The process of Bottcher et al. is the same as the instantly claimed process, but Bottcher et al. is silent as to whether the flow path **1** may comprise a microchannel, such that the minimum dimension of the flow path is at least 10 μm, and the maximum dimension of the flow path is at most 1000 μm.

Haswell et al., however, teaches the known use of flow paths configured as microchannels for performing chemical and biochemical reactions, with the flow paths having dimensions within the instantly claimed ranges (e.g., 500 μm, page 391, last line in column 1; 700 μm, page 392, column 1; 300 μm wide and 115 μm deep, page 393, column 1).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the continuous flow path in the process of Bottcher et al. with microchannel dimensions, because the microchannel dimensions enables rapid mass and heat transfer to be achieved within the device, thereby providing a higher level of reaction control and reaction manipulation, as taught by Haswell et al. (see page 389, column 2). Furthermore, it has been held that changes in size involve only ordinary skill in the art. *In re Rose*, 220 F.2d 459, 463, 105 USPQ 237, 240 (CCPA 1955).

Regarding claims 25, 77 and 97, the unit operation is selected from the group consisting of chemical reaction, vaporization, compression, chemical separation, distillation and condensation (see column 2, lines 49-55).

11. Claims 27-29 and 84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Symonds (WO 01/35043) in view of McCausland (US 2,209,346).

Regarding claims 27-29, Symonds discloses a process comprising:

stacking a plurality of shims (i.e., discs **22** within portion **11** of assembly **10**; FIGs. 1 and 2) such that a continuous first flow path is formed through the shims (i.e., as defined by aligned openings **29**, between inlet **12** and outlet **13**), and a continuous second flow path is formed through the shims (i.e., as defined by aligned openings **26**, between inlet **21** and outlet **19**);

wherein the first and second flow paths are substantially parallel to the shim thickness (see, e.g., FIG. 1);

wherein the plurality of shims **22** comprise at least three shims through which the first and second flow paths are formed, and wherein a straight, unobstructed line is present through the first flow path **12/29/13** in said at least three shims; and a straight, unobstructed line is present through the second flow path **21/26/19** in said at least three shims (see FIGs. 1, 2);

bonding the shims (see page 6, second paragraph) to form a device capable of performing a unit operation on a fluid;

passing a first fluid into the device (i.e., via inlet **12**) such that the fluid passes through the first flow path in said plurality of shims; and performing at least one first unit operation on the first fluid as it passes through the first flow path (e.g., reacting, in the case of the device being configured as a packed bed catalytic reactor; page 1, second paragraph; page 4, second to last paragraph; claim 26); and

passing a second fluid into the device (i.e., via inlet **21**) such that the fluid passes through the second flow path in said plurality of shims; and performing at least one second unit operation on the second fluid as it passes through the second flow path (e.g., heating or cooling with a fluid for controlling the temperature of the catalytic reaction occurring within the first flow path).

Symonds, however, is silent as to the first unit operation comprising an exothermic catalytic reaction, and the second unit operation comprising, for instance, vaporization. In any event, it would have been obvious for one of ordinary skill in the art at the time the invention was made to select an exothermic catalytic reaction for the first unit operation and vaporization for the second unit operation in the process of Symonds, on the basis of suitability for the

intended use and absent a showing of unexpected results thereof, because the use of heat exchange devices for conducting exothermic catalytic reactions, wherein the control of the reaction temperature is provided by a heat transfer fluid that exhibits a phase change such as vaporization, would have been considered conventional in the art, as evidenced by McCausland (see column 1, lines 7-52).

Regarding claim 84, although Symonds is silent as to the catalyst forming the "packed bed catalytic reactor" comprising a catalyst metal on an oxide support, it would have been obvious for one of ordinary skill in the art at the time the invention was made to select such materials for the particulate catalyst in the process of Symonds, on the basis of suitability for the intended use thereof, because the Examiner takes Office Notice that particulate catalysts are commonly formed of such materials.

12. Claims 82 and 83 are rejected under 35 U.S.C. 103(a) as being unpatentable over Symonds (WO 01/35043) in view of McCausland (US 2,209,346), as applied to claims 27 and 28 above, and further in view of Gaiser (US 6,187,273).

Symonds discloses that the catalyst within the first flow path comprises a packed bed of catalyst (see, for example, page 1, second paragraph; page 4, second to last paragraph; claim 26). Symonds, however, is silent as to whether the catalyst may, instead, comprise a metal film on the edge of the flow path. Gaiser teaches the conventionality of providing a metal film of catalyst (e.g., FIG. 6) as an alternative to a packed bed of catalyst (e.g., FIG. 12). It would have been obvious for one of ordinary skill in the art at the time the invention was made to substitute a metal film of catalyst for the packed bed of catalyst in the process of Symonds, because a metal film of catalyst would have been considered conventional in the art of catalysis, as evidenced by

Gaiser, and furthermore, the substitution of known equivalent structures involves only ordinary skill in the art. *In re Fout* 213 USPQ 532 (CCPA 1982); *In re Susi* 169 USPQ 423 (CCPA 1971); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); In re Ruff 118 USPQ 343 (CCPA 1958).

13. Claim 91 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bottcher et al. (US 5,657,818) in view of Symonds (WO 01/35043).

Bottcher et al. discloses that the device may be used for performing various unit operations, including heat exchanging and reacting, etc. (see column 2, lines 49-55). Bottcher et al., however, is silent as to the provision of a catalyst or sorbent within the flow path. In any event, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide, for instance, a catalyst within the continuous flow path in the process of Bottcher et al., because the provision of catalyst for enabling a chemical reaction within a heat exchanging device would have been considered conventional in the art, as evidenced by Symonds (i.e., the configuration of a heat exchanging device as packed bed catalytic reactor; see page 1, second paragraph; page 4, second to last paragraph; claim 26).

Allowable Subject Matter

14. Claims 5 and 98 contain allowable subject matter. The prior art does not disclose or adequately suggest the instantly claimed process comprising forming of the device, wherein a first catalyst or sorbent is placed in the first flow path and a second catalyst is placed in the second flow path, the second catalyst being different than the first catalyst or sorbent.

15. Claims 30, 31, 80 and 81 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 30, the prior art does not disclose or adequately suggest the instantly claimed process comprising the forming of the device and the performing of a unit operation within the flow paths of the device, wherein the unit operation comprises at least two different unit operations including an exothermic reaction for the first unit operation within the first flow path and an endothermic reaction for the second unit operation within the second flow path.

Regarding claim 31, the prior art does not disclose or adequately suggest the instantly claimed process comprising the forming of the device and the performing of a unit operation within the flow paths of the device, wherein the unit operation comprises at least two different unit operations including combustion within the flow path and steam reforming within the second flow path.

Regarding claims 80 and 81, the prior art does not disclose or adequately suggest the instantly claimed process comprising the forming of the device and the performing of a unit operation within the flow paths of the device, wherein the unit operation comprises at least two different unit operations using catalysts placed in both the flow path and the second flow path, respectively, wherein the catalysts within each flow path are different.

Response to Arguments

16. Applicant's arguments with respect to the rejection of claims 1-4, 6-13, 15, 27-30, 75, 78, 79, 82, 83 and 85 under 35 U.S.C. 102(b) as being anticipated by Yamashita et al., and Applicant's arguments with respect to the rejection of claims 24-26 under 35 U.S.C. 103(a) as being obvious over Yamashita et al., have been carefully considered. In view of the various newly added limitations in claims 1, 10, 13, 24 and 27, said rejections have now been withdrawn.

17. Applicant's argument with respect to the rejection of claim 10 under 35 U.S.C. 102(b) as being anticipated by Symonds has been fully considered, but the argument is not found persuasive. Applicant (at page 19, second to last paragraph) argues that claim 10, as amended, recites unit operations or combination of unit operations that are not taught or suggested by Symonds. However, the Examiner respectfully disagrees. In particular, it is noted that Symonds discloses that the first unit operation may comprise reacting (i.e., in the case of the device being configured as a packed bed catalytic reactor; page 1, second paragraph; page 4, second to last paragraph; claim 26), and the second unit operation may comprise heating or cooling (i.e., to control the temperature of the catalytic reaction occurring within the first flow path).

18. Applicant's arguments with respect to the incorporation of the allowable subject from claims 23, 31, 80 and 81 have been fully considered. It is noted, however, the subject matter from the allowable claims, as well as any intervening claim, was not fully incorporated into the independent claims.

19. Applicant's arguments with respect to the remaining rejected claims have been fully considered. However, the arguments are moot in view of the new grounds of rejection that were necessitated by amendment.

Conclusion

20. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

* * *

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer A. Leung whose telephone number is (571) 272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jennifer A. Leung JAL
July 20, 2007

Glenn Caldarola
Supervisory Patent Examiner
Technology Center 1700